Michael Allen Heroux

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Experience

Distinguished Member of Technical Staff. Computational and Applied Mathematics Department, Sandia National Labs, May 1998–present. *Conduct research and development of numerical methods for scientific and engineering applications on large-scale parallel computers. Participate on program and standards committees in areas of expertise. Lead the Trilinos Solver Project (http://software.sandia.gov/Trilinos). Telecommute from rural central Minnesota.*

Scientist in Residence. Department of Computer Science, Saint John's University, September 1998–present. *Teach courses in Numerical Analysis, High Performance Computing, Computer Science Research Methodologies and Software Engineering. Direct undergraduate research theses in parallel computing and related areas.*

Group Leader. Scalable Computing, Algorithms and Capability Prototyping Groups, SGI/Cray Research, March 1995–May 1997. *Led a team of specialists in scientific computing. Directed activities and participated in development, porting and optimization of large scale parallel applications for SGI/Cray systems. Participated in and led standardization efforts for scientific computing. Led efforts in development of new application capabilities. Provided applications analysis and requirements to future computer systems development including the Cray T3E, T90, J90, SV1 and SV2.*

Numerical Analyst. CFD Group, Engineering Applications, Cray Research, September 1993–February 1995. *Responsible for research and development of numerical methods for engineering applications in CFD, structural analysis, electronics and reservoir simulation. Work with application developers to install and run industrial applications on Cray vector multiprocessors and distributed memory machines. Particular areas of interest were the solution of sparse and dense linear systems, iterative methods, parallel algorithms and large scale scientific computation. Served as consultant on numerical methods for Cray Research customers and application specialists.*

Intern Director. Cray Research, June 1989–May 1997. Brought graduate students and post-docs in Math/CS to work at Cray. Worked with students from Kent State, Stanford, Carnegie Mellon and the Universities of Illinois, Minnesota, Northern Illinois and Tennesee. Worked with students on their dissertation topic with a special emphasis on application to industrial problems.

Numerical Analyst. Mathematical Software Research Group, Cray Research, October 1988–September 1993. *Conducted research and development of numerical linear algebra libraries. Served as consultant on numerical methods for Cray Research customers and application specialists. Developed libraries of high-performance software for Cray Research computer systems.*

Education

Ph.D. Mathematics. May 1989, Colorado State University, Fort Collins, Colorado.

M.S. Mathematics. August 1986, Colorado State University, Fort Collins, Colorado.

B.A. Mathematics. December 1983, Saint John's University, Collegeville, Minnesota.

Professional Awards and Service

SC2004 HPC Software Challenge Award, 2004.

R&D 100 Award for Trilinos 3.1, 2004.

Sandia Employee Recognition Award: Leadership of Trilinos Project, 2004.

Sandia Employee Recognition Award: Member of Xyce Development Team, 2004.

Program Director for SIAM Supercomputing Special Interest Group, 2000–2003.

Program Chair for 2004 SIAM Parallel Processing Conference.

Sandia Award for Excellence: Efforts in Nanosciences Initiative, 2003.

Sandia Award for Excellence: Development of Algorithms for Circuit Simulation, 2001.

Sandia Award for Excellence: Development of Parallel Circuit Simulation Code, 2000.

Member of Cray Research Gordon Bell Prize Finalist Team, 1996.

Program Committee member: SIAM 1999 Parallel Processing Conference, SC2000.

Referee for SIAM Journal of Scientific Computing, SIAM Review, ACM Transactions on Mathematical Software, IEEE Transactions on Parallel and Distributed Systems, 1999–present.

Professional Memberships

The Society for Industrial and Applied Mathematics.

The Association for Computing Machinery.

Presentations

Trilinos Overview Invited Presentation: Rice University, Bettis National Laboratory, Lawrence Berkeley National Laboratory, IBM TJ Watson, University of MN.

Using GPUs as CPUs for Engineering Applications, GP2 Workshop, August 2004 Los Angeles, CA.

Trilinos Short Course, SIAM Computational Science and Engineering Conference, February 2005, Orlando, FL.

Software Design Issues for Linear Algebra Software, Preconditioning 2005, May 2005, Atlanta, GA.

Publications

See attached.

Publications

[1] R. A. Bartlett, B. G. van Bloemen Waanders, and M. A. Heroux. Vector reduction/transformation operators. *ACM Transactions on Mathematical Software*, 30(1):62–85, March 2004.

[2] S. Blackford, J. Demmel, J. Dongarra, I. Duff, S. Hammarling, G. Henry, M. Heroux, L. Kaufman, A. Lumsdaine, A. Petitet, R. Pozo, K. Remington, and R. C. Whaley. An updated set of basic linear algebra subprograms (BLAS). *ACM Transactions on Mathematical Software*, 28(2):135–151, June 2002.

[3] Guy E. Blelloch, Michael A. Heroux, and Marco Zagha. Segmented operations for sparse matrix computations on vector multiprocessors. Technical report, School of Computer Science, Carnegie Mellon University, Pittsburgh, PA., August 1993.

[4] E. Boman, K. Devine, R. Heaphy, B. Hendrickson, M. Heroux, and R. Preis. Ldrd report: Parallel repartitioning for optimal solver performance. Technical Report SAND2004-0365, Sandia National Laboratories, February 2004.

[5] Jonathan L. Brown, Sue Goudy, Michael A. Heroux, Shan Shan Huang, and Zhaofang Wen. An Envolutionary Path towards Virtual Shared Memory with Random Access. In *Proceeding of SPAA 2006*, 2006. To Appear.

[6] Sandra Carney, Michael A. Heroux, Guangye Li, and Kesheng Wu. A revised proposal for a sparse BLAS toolkit. Technical Report 94-034, Army High Performance Computing Research Center, June 1994.

[7] Edmond Chow and Michael A. Heroux. An object-oriented framework for block preconditioning. *ACM Transactions on Mathematical Software*, 24(2):159–183, June 1998.

[8] David Day and Michael A. Heroux. Solving complex-valued linear systems via equivalent real formulations. *SIAM J. Sci. Comput.*, 23(2):480–498, 2001.

[9] C. C. Douglas, M. Heroux, G. Slishman, and R. M. Smith. Gemmw: A portable level 3 blas winograd variant of strassen's matrix–matrix multiply algorithm. *J. Comput. Phys.*, 110:1–10, 1994.

[10] I. Duff, M. Heroux, and R. Pozo. An overview of the Sparse Basic Linear Algebra Subprograms: The new standard from the BLAS Technical Forum. *ACM Transactions on Mathematical Software*, 28(2):239–267, June 2002.

[11] M. A. Heroux, H. Simon, and A. E. Koniges. The future of industrial parallel computing. In A. E. Koniges, editor, *Industrial Strength Parallel Computing*, chapter 25. Morgan Kaufman, 2000.

[12] Michael Heroux, Roscoe Bartlett, Vicki Howle Robert Hoekstra, Jonathan Hu, Tamara Kolda, Richard Lehoucq, Kevin Long, Roger Pawlowski, Eric Phipps, Andrew Salinger, Heidi Thornquist, Ray Tuminaro, James Willenbring, and Alan Williams. An Overview of Trilinos. Technical Report SAND2003-2927, Sandia National Laboratories, 2003.

[13] Michael A. Heroux. A Solver-Independent API for multi-DOF Applications using Trilinos. *Int. J. of Computational Science and Engineering*. Submitted.

[14] Michael A. Heroux. *The Komplex Solver Package Reference Manual 1.0*. Sandia National Laboratories, Albuquerque, NM 87185, 2000.

[15] Michael A. Heroux. AztecOO Users Guide. Technical Report SAND2004-3796, Sandia National Laboratories, 2004.

[16] Michael A. Heroux, Roscoe A. Bartlett, Vicki E. Howle, Robert J. Hoekstra, Jonathan J. Hu, Tamara G. Kolda, Richard B. Lehoucq, Kevin R. Long, Roger P. Pawlowski, Eric T. Phipps, Andrew G. Salinger, Heidi K. Thornquist, Ray S. Tuminaro, James M. Willenbring, Alan Williams, and Kendall S. Stanley. An overview of the trilinos project. *ACM Trans. Math. Softw.*, 31(3):397–423, 2005.

[17] Michael A. Heroux, Laura J. D. Frink, and Andrew G. Salinger. Segregated Schur complement approaches to solving density functional theories for inhomogeneous fluids on parallel computers. *SIAM J. Sci. Comput.* Submitted.

[18] Michael A. Heroux, Padma Raghavan, and Horst D. Simon. *Parallel Processing for Scientific Computing*. SIAM, 2006. To Appear.

[19] Michael A. Heroux, Padma Raghavan, and Horst D. Simon. *Parallel Processing for Scientific Computing*, chapter Frontiers of Scientific Computing: An Overview. SIAM, 2006. To Appear.

[20] Michael A. Heroux, Padma Raghavan, and Horst D. Simon. *Parallel Processing for Scientific Computing*, chapter Opportunities and Challenges for Parallel Computing in Science and Engineering. SIAM, 2006. To Appear.

[21] Michael A. Heroux and Marzio Sala. The Design of Trilinos. In *Proceeding of PARA'04*, 2005.

[22] Michael A. Heroux and James M. Willenbring. Trilinos Users Guide. Technical Report SAND2003-2952, Sandia National Laboratories, 2003.

[23] Michael A. Heroux, James M. Willenbring, and Robert Heaphy. Trilinos Developers Guide. Technical Report SAND2003-1898, Sandia National Laboratories, 2003.

[24] Michael A. Heroux, James M. Willenbring, and Robert Heaphy. Trilinos Developers Guide Part II: ASCI Software Quality Engineering Practices Version 1.0. Technical Report SAND2003-1899, Sandia National Laboratories, 2003.

[25] Serge Kharchenko, Paul Kolesnikov, Andy Nikishin, Alex Yeremin, Michael Heroux, and Qasim Sheikh. Iterative solution methods on the Cray YMP/C90. Part II: Dense linear systems. In *Proceedings of the 1993 Simulation Multiconference*, 1993.

[26] A. E. Koniges, D. C. Eder, and M. A. Heroux. Designing industrial parallel applications. In A. E. Koniges, editor, *Industrial Strength Parallel Computing*, chapter 24. Morgan Kaufman, 2000.

[27] Eugene L. Poole, Michael A. Heroux, Pravin Vaidya, and Anil Joshi. Performance of iterative methods in ANSYS on cray parallel/vector supercomputers. *Computing Systems in Engineering*, 6:251–259, 1995.

[28] Marzio Sala, Michael A. Heroux, Robert J. Hoekstra, and Alan Williams. Serialization and Deserialization Tools for Distributed Linear Algebra Objects. Technical Report SAND2006-2838, Sandia National Laboratories, 2006.

[29] Marzio Sala, William F. Spotz, and Michael A. Heroux. PyTrilinos: High-Performance Distributed-Memory Solvers for Python. *ACM Transactions on Mathematical Software*, 2006. Submitted.

[30] Marzio Sala, Kendall S. Stanley, and Michael A. Heroux. On the Design of Interfaces to Sparse Direct Solvers. *ACM Transactions on Mathematical Software*, 2006. Submitted.

[31] P. R. Schunk and M. A. Heroux. Iterative solver preconditioners for finite element formulations of multiphysics problems including incompressible fluid and solid mechanics. In *Proceedings of the International Conference on Computational Engineering and Sciences, ICES'01*, 2001.

[32] P. R. Schunk, M. A. Heroux, R. R. Rao, T. A. Baer, S. R. Subia, and A. C. Sun. Preconditioned iterative solvers applied to mixed v-p finite element formulations of incompressible flows and coupled transport processes. Technical Report SAND2001-3512J, Sandia National Laboratories, 2001.

[33] Ray S. Tuminaro, Michael A. Heroux, Scott. A. Hutchinson, and J. N. Shadid. *Official Aztec User's Guide, Version 2.1.* Sandia National Laboratories, Albuquerque, NM 87185, 1999.

[34] David E. Womble, Bruce A. Hendrickson, David S. Greenberg, James L. Tomkins, Sudip S. Dosanjh, Steve J. Plimpton, and Michael A. Heroux. An overview of MP computing and applications. *Parallel Computing*, March 2000.